ISSN 1346-7565 Acta Phytotax. Geobot. 56 (3): 261–263 (2005)

Short Communication
A New Locality of *Adonis multiflora* (Ranunculaceae) in Japan

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The large population of *Adonis* has been known from Hiroshima Prefecture, western Honshu, Japan. The *Adonis* species was formerly regarded as *A. ramosa*. However, based on the detailed examinations of flowers and fruits, this species is here identified as *A. multiflora*. This is the first report of *A. multiflora* from western Honshu, Japan.

Key words: *Adonis multiflora*, Hiroshima Prefecture, Honshu, Japan, new locality

The large *Adonis* population around Taishaku-kyo Gorge, northeast of Hiroshima Prefecture, was previously considered to be *A. ramosa* Franch. (Yamashita 1987, Kaneko *et al.* 2002, Hiroshima Prefecture 2004), and this was because *A. ramosa* was believed to be the only *Adonis* species native to Japan (Ohwi 1983). However, recent studies (Nishikawa & Ito 1978, 1979, 2001, Nishikawa 1988, 1989a, 1989b) have shown that the Japanese *Adonis* consists of the following four species; *A. amurensis* Regel & Radde, *A. ramosa*, *A. multiflora* Nishikawa & Ko. Ito (Nishikawa 1989a) and *A. shikokuensis* Nishikawa & Ko. Ito (Nishikawa & Ito 2001). In this report morphological characters of flowers and fruits were examined to enable the exact determination of the *Adonis* species in this area.

To confirm the identification of the *Adonis* species in Hiroshima Prefecture, the ratio of the sepal length to petal length, the ratio of aggregate fruit length to width, the length of aggregate fruit, and the number of achenes per aggregate fruit were measured in the three populations. The length of aggregate fruit and the number of achenes per aggregate fruit were also examined in the six populations, including four *Adonis* species from other localities in Japan (Fig. 1). Voucher specimens are deposited at Hiwa Museum of Natural History, Shobara, Hiroshima Prefecture.

Adonis multiflora is morphologically similar to *A. ramosa* in having several branches with one flower per stem, with alternate leaf arrangement and leaves which are glabrous but rarely hairy underneath (Nishikawa 2001). The two species differ from each other in terms of the ratio of sepal length to petal length, the shape of aggregate fruits, and particularly the length of aggregate fruits and the number of achenes per aggregate fruit. *Adonis multiflora* has sepals 1/2-2/3 shorter than petals, with spherical aggregate fruits, having 35 achenes on average. On the other hand, *A. ramosa* has sepals nearly equal to petals, and prolate spheroid aggregate fruit with 55 achenes (Nishikawa 1988, Nishikawa & Ito 2001).

The ratio of sepal length to petal length of

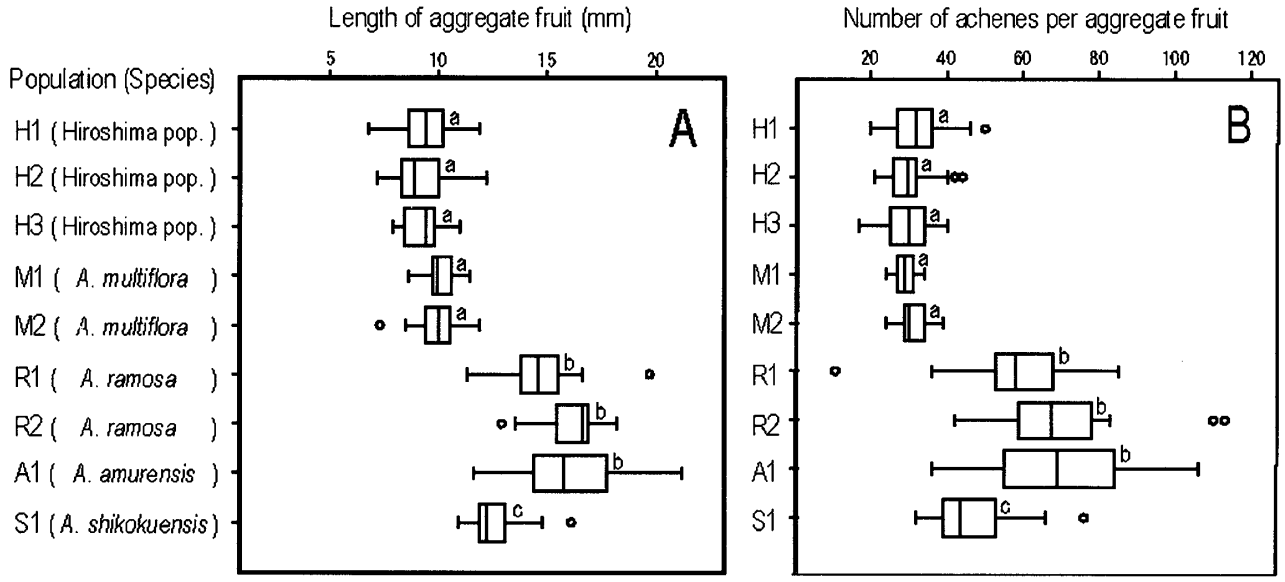

FIG. 1. A. Length of aggregate fruits of *Adonis* spp. B. Number of achenes per aggregate fruit. Abbreviations of nine populations (H1-H3: Taishaku-kyo Gorge, Hiroshima Pref., M1: Ina, Nagano Pref., M2: Katsuyama, Fukui Pref., R1: Hachinohe, Aomori Pref., R2: Ina, Nagano Pref., A1: Nemuro, Hokkaido Pref., S1: Ôtoyo, Kôchi Pref.). Thirty aggregate fruits were examined in each population. Box plots show median (line), 25th and 75th percentiles (box), 10th and 90th percentiles (whiskers) and outliers (points). Different letters (a-c) indicate significant disparity in the mean values of both groups ($P < 0.05$, Scheffe's test).

Adonis species around Taishaku-kyo Gorge in Hiroshima Prefecture was 0.71 ± 0.10 (range: 0.49 - 0.94, N = 90), and their length were 10.7 ± 2.16 mm (range: 5.2 - 16.1mm, N = 90) and 15.7 ± 3.43 mm (range: 8.5 - 26.4mm, N = 90). These plants had sepals clearly shorter than their petals. The ratio of aggregate fruit length to width was 0.98 ± 0.06 (range: 0.85 - 1.05, N = 90), and these plants had spherical aggregate fruits. Figure 1 shows the length of aggregate fruit and the number of achenes per aggregate fruit. The present *Adonis* species was not significantly different from *A. multiflora*, but significantly different from the other three species of *Adonis* (*A. ramosa, A. amurensis,* and *A. shikokuensis*). Based on these results, the *Adonis* species found around Taishaku-kyo Gorge in Hiroshima Prefecture should be ascribed to *A. multiflora,* and not *A. ramosa.*

Nishikawa & Ito (2001) reported the distribution of *Adonis multiflora* in northern Honshu and Kyushu. However, the *Adonis* species reported in western Honshu was regarded as *A. ramosa* (Environmental Agency 2000, Hiroshima Prefecture 2004, Shimane Prefecture 2004), and not *A. multiflora*. The presence of *A. multiflora* in Hiroshima Prefecture showed that this species is distributed in western Honshu. Hence there is a possibility that in western Honshu, Hiroshima Prefecture, *A. multiflora* is found also at other localities in the vicinity of Taishaku-kyo Gorge.

The population of *Adonis multiflora* located around the Taishaku-kyo Gorge, Hiroshima Prefecture, is also worthy of special mention for conservation of this species, and at least ten thousand individuals are found in this area. According to the Environmental Agency of Japan (2000), the estimated number of individuals of *A. multiflora* in Japan was approximately ten thousands. Therefore the population of *A. multiflora* in Hiroshima could be one of the largest stocks of this threatened species in Japan.

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Received March 22, 2005; accepted August 23, 2005